

## N-Channel Enhancement Mode Power MOSFET

## Description

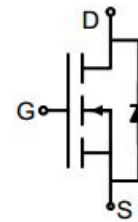
The GT040N10T uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge. It can be used in a wide variety of applications.

## General Features

- $V_{DS}$  100V
- $I_D$  (at  $V_{GS} = 10V$ ) 140A
- $R_{DS(ON)}$  (at  $V_{GS} = 10V$ ) < 4.5m $\Omega$
- $R_{DS(ON)}$  (at  $V_{GS} = 4.5V$ ) < 5.5m $\Omega$
- 100% Avalanche Tested
- RoHS Compliant

## Application

- Power switch
- DC/DC converters



Schematic diagram



TO-220

## Ordering Information

| Device    | Package | Marking  | Packaging  |
|-----------|---------|----------|------------|
| GT040N10T | TO-220  | GT040N10 | 50pcs/Tube |

Absolute Maximum Ratings  $T_C = 25^\circ\text{C}$ , unless otherwise noted

| Parameter                                        | Symbol         | Value      | Unit             |
|--------------------------------------------------|----------------|------------|------------------|
| Drain-Source Voltage                             | $V_{DS}$       | 100        | V                |
| Continuous Drain Current                         | $I_D$          | 140        | A                |
|                                                  |                | 89         |                  |
| Pulsed Drain Current (note1)                     | $I_{DM}$       | 560        | A                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$   | V                |
| Power Dissipation                                | $P_D$          | 200        | W                |
| Single pulse avalanche energy (note2)            | $E_{AS}$       | 420        | mJ               |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | -55 To 150 | $^\circ\text{C}$ |

## Thermal Resistance

| Parameter                               | Symbol     | Value | Unit               |
|-----------------------------------------|------------|-------|--------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 50    | $^\circ\text{C/W}$ |
| Maximum Junction-to-Case                | $R_{thJC}$ | 0.625 | $^\circ\text{C/W}$ |

| Specifications T <sub>J</sub> = 25°C, unless otherwise noted |                      |                                                                          |       |      |      |      |
|--------------------------------------------------------------|----------------------|--------------------------------------------------------------------------|-------|------|------|------|
| Parameter                                                    | Symbol               | Test Conditions                                                          | Value |      |      | Unit |
|                                                              |                      |                                                                          | Min.  | Typ. | Max. |      |
| Static Parameters                                            |                      |                                                                          |       |      |      |      |
| Drain-Source Breakdown Voltage                               | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                             | 100   | --   | --   | V    |
| Zero Gate Voltage Drain Current                              | I <sub>DSS</sub>     | V <sub>DS</sub> = 100V, V <sub>GS</sub> = 0V                             | --    | --   | 1    | μA   |
| Gate-Source Leakage                                          | I <sub>GSS</sub>     | V <sub>GS</sub> = ±20V                                                   | --    | --   | ±100 | nA   |
| Gate-Source Threshold Voltage                                | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA               | 1.0   | 1.9  | 2.5  | V    |
| Drain-Source On-Resistance                                   | R <sub>DS(on)</sub>  | V <sub>GS</sub> = 10V, I <sub>D</sub> = 40A                              | --    | 3.7  | 4.5  | mΩ   |
|                                                              |                      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 40A                             | --    | 4.6  | 5.5  |      |
| Forward Transconductance                                     | g <sub>FS</sub>      | V <sub>GS</sub> = 5V, I <sub>D</sub> = 40A                               | --    | 88   | --   | S    |
| Dynamic Parameters                                           |                      |                                                                          |       |      |      |      |
| Input Capacitance                                            | C <sub>iss</sub>     | V <sub>GS</sub> = 0V,<br>V <sub>DS</sub> = 50V,<br>f = 1.0MHz            | --    | 5920 | --   | pF   |
| Output Capacitance                                           | C <sub>oss</sub>     |                                                                          | --    | 755  | --   |      |
| Reverse Transfer Capacitance                                 | C <sub>rss</sub>     |                                                                          | --    | 65   | --   |      |
| Total Gate Charge                                            | Q <sub>g</sub>       | V <sub>DD</sub> = 50V,<br>I <sub>D</sub> = 40A,<br>V <sub>GS</sub> = 10V | --    | 100  | --   | nC   |
| Gate-Source Charge                                           | Q <sub>gs</sub>      |                                                                          | --    | 16   | --   |      |
| Gate-Drain Charge                                            | Q <sub>gd</sub>      |                                                                          | --    | 20   | --   |      |
| Turn-on Delay Time                                           | t <sub>d(on)</sub>   | V <sub>DD</sub> = 50V,<br>I <sub>D</sub> = 40A,<br>R <sub>G</sub> = 1.6Ω | --    | 24   | --   | ns   |
| Turn-on Rise Time                                            | t <sub>r</sub>       |                                                                          | --    | 18   | --   |      |
| Turn-off Delay Time                                          | t <sub>d(off)</sub>  |                                                                          | --    | 54   | --   |      |
| Turn-off Fall Time                                           | t <sub>f</sub>       |                                                                          | --    | 14   | --   |      |
| Drain-Source Body Diode Characteristics                      |                      |                                                                          |       |      |      |      |
| Continuous Body Diode Current                                | I <sub>S</sub>       | T <sub>C</sub> = 25°C                                                    | --    | --   | 140  | A    |
| Body Diode Voltage                                           | V <sub>SD</sub>      | T <sub>J</sub> = 25°C, I <sub>SD</sub> = 40A, V <sub>GS</sub> = 0V       | --    | --   | 1.2  | V    |
| Reverse Recovery Charge                                      | Q <sub>rr</sub>      | I <sub>F</sub> = 40A, V <sub>GS</sub> = 0V<br>di/dt=100A/us              | --    | 174  | --   | nC   |
| Reverse Recovery Time                                        | T <sub>rr</sub>      |                                                                          | --    | 98   | --   | ns   |

## Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. EAS condition :  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 50V$ ,  $V_{GS} = 10V$ ,  $L = 0.5mH$ ,  $R_G = 25\Omega$

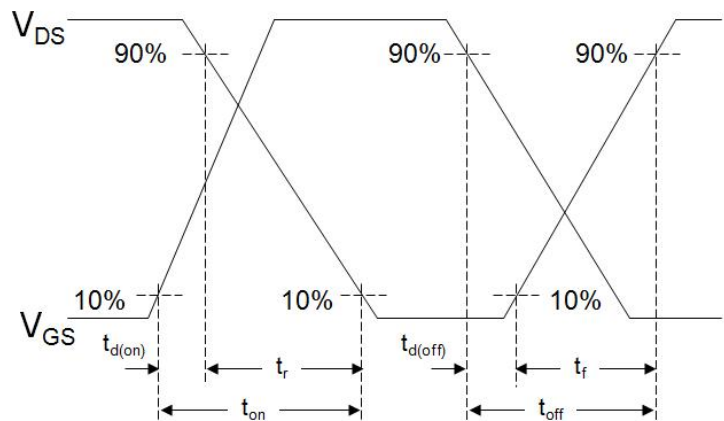
The table shows the minimum avalanche energy, which is 1156mJ when the device is tested until failure

3. Identical low side and high side switch with identical  $R_G$

### Gate Charge Test Circuit



### Switch Time Test Circuit

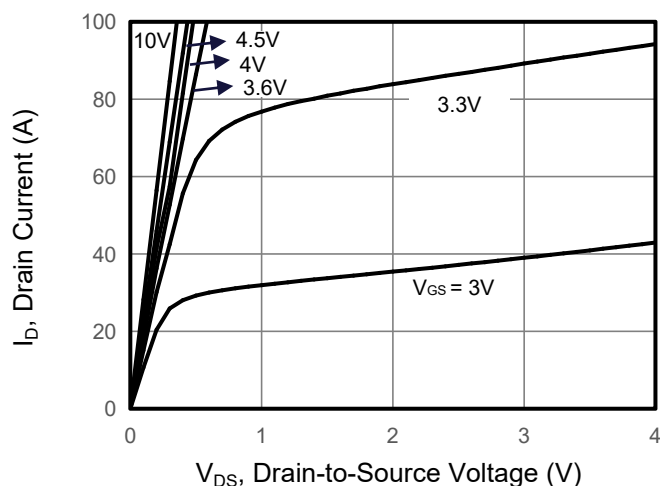


### EAS Test Circuit

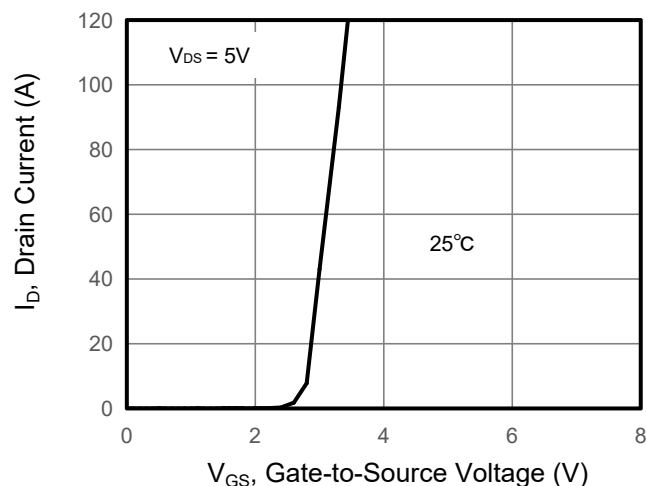


**Typical Characteristics**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

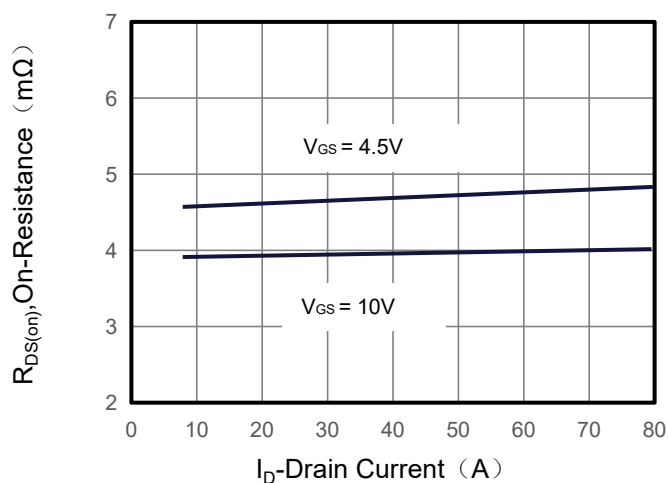
**Figure 1. Output Characteristics**



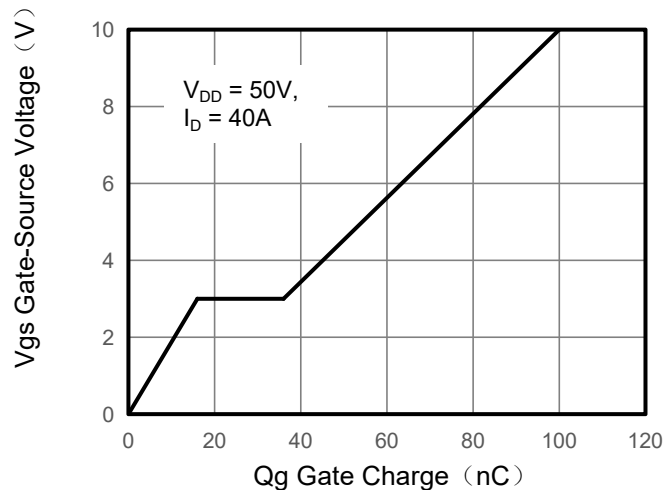
**Figure 2. Transfer Characteristics**



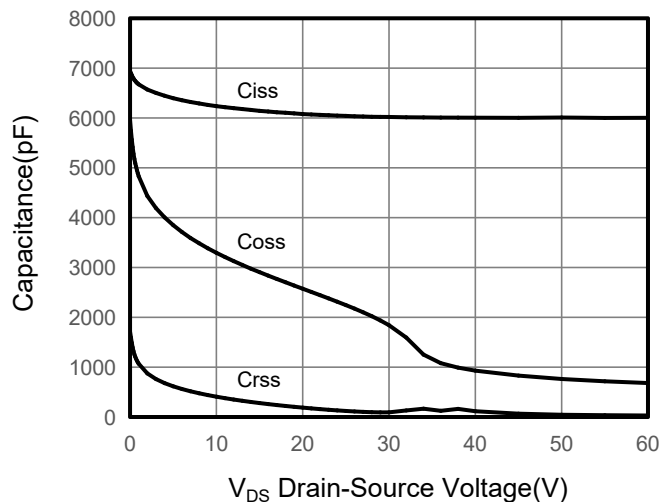
**Figure 3. Drain Source On Resistance**



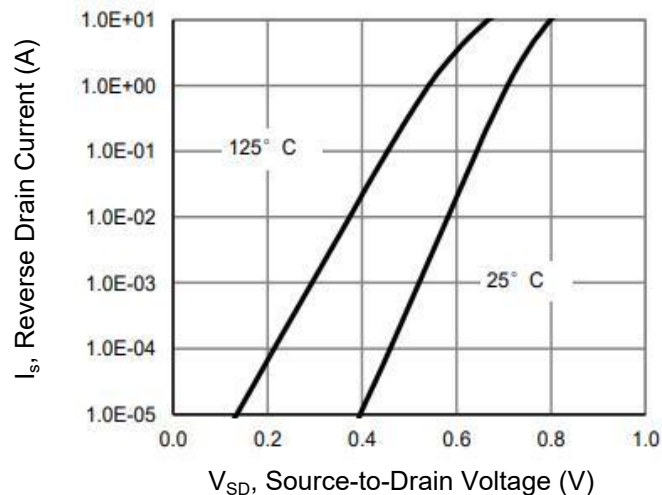
**Figure 4. Gate Charge**



**Figure 5. Capacitance**

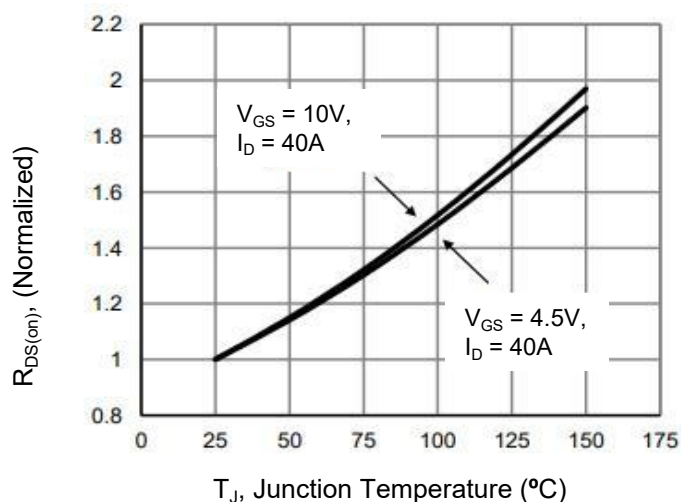


**Figure 6. Source-Drain Diode Forward**

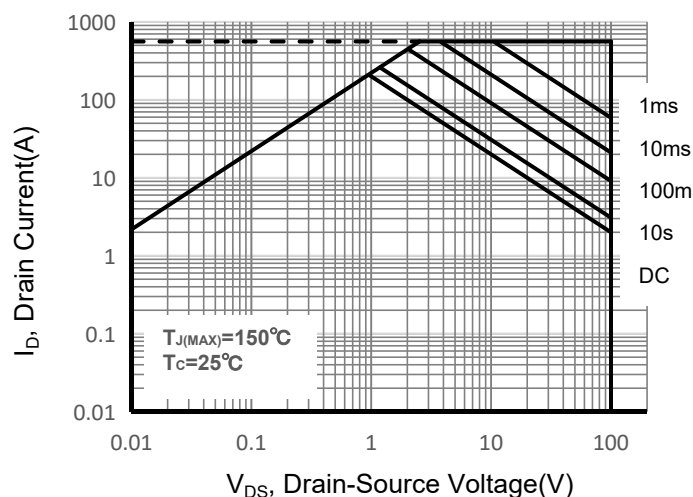


**Typical Characteristics**  $T_J = 25^\circ\text{C}$ , unless otherwise noted

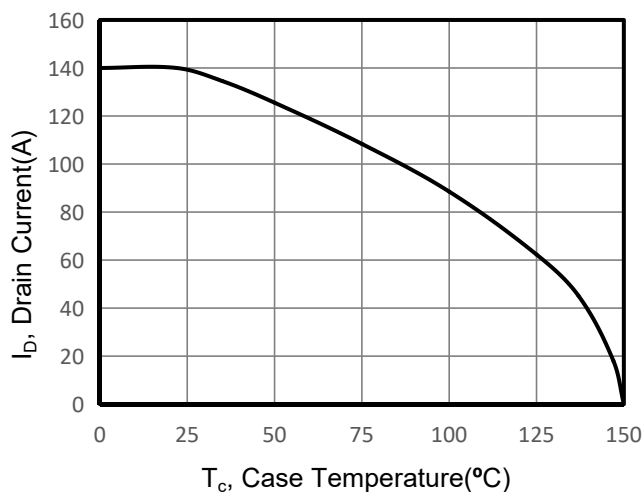
**Figure 7. Drain-Source On-Resistance**



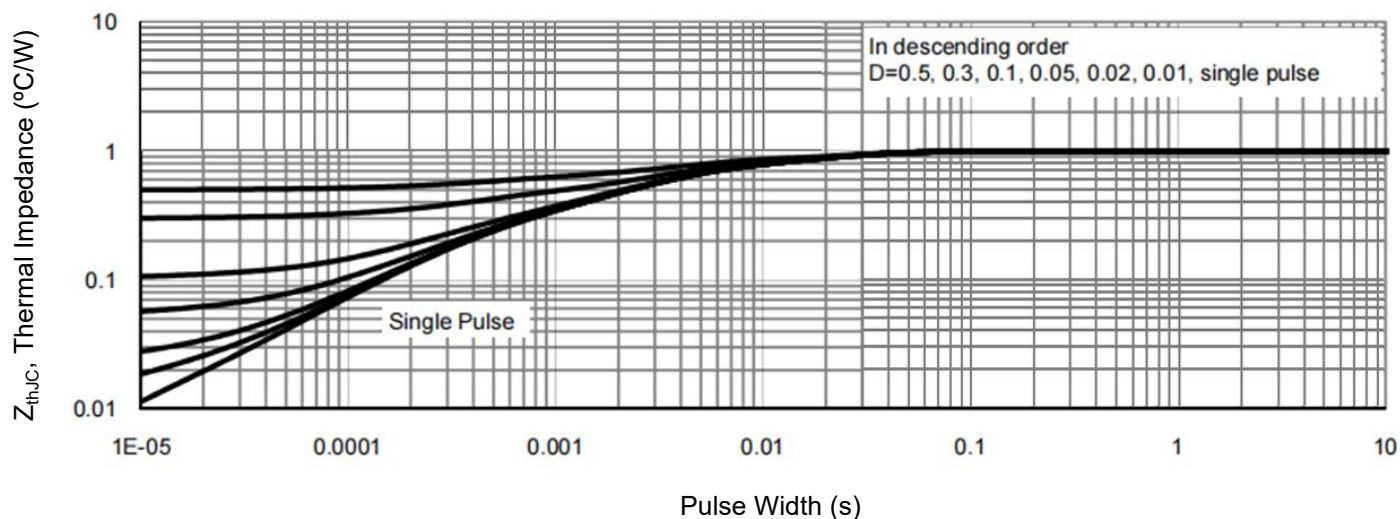
**Figure 8. Safe Operation Area**



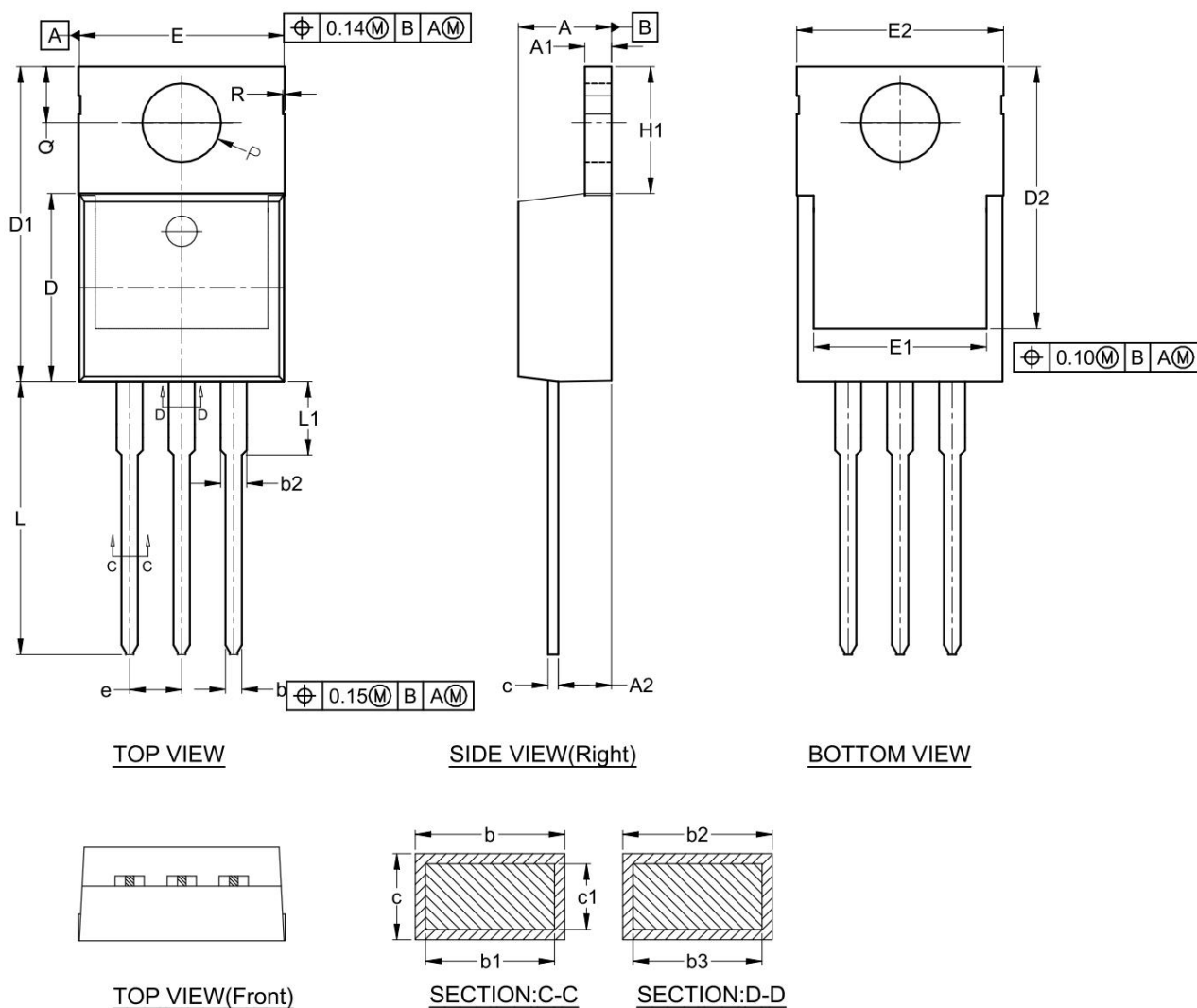
**Figure 9. Maximum Continuous Drain Current vs Case Temperature**



**Figure 10. Normalized Maximum Transient Thermal Impedance**



## TO-220 Package Information



| DIM<br>SYMBOL | MIN.   | NOM.   | MAX.   | DIM<br>SYMBOL | MIN.       | NOM.   | MAX.   |
|---------------|--------|--------|--------|---------------|------------|--------|--------|
| A             | 4.450  | 4.550  | 4.650  | D2            | 12.610     | 12.810 | 13.010 |
| A1            | 1.240  | 1.340  | 1.440  | E             | 9.900      | 10.000 | 10.100 |
| A2            | 2.500  | 2.600  | 2.700  | E1            | 8.240      | 8.440  | 8.640  |
| b             | 0.740  | 0.840  | 0.940  | E2            | 9.900      | 10.100 | 10.300 |
| b1            | 0.700  | 0.800  | 0.900  | e             | 2.540 BSC. |        |        |
| b2            | 1.210  | 1.310  | 1.410  | H1            | 6.000      | 6.200  | 6.400  |
| b3            | 1.170  | 1.270  | 1.370  | L             | 13.140     | 13.340 | 13.540 |
| c             | 0.440  | 0.540  | 0.640  | L1            | 3.385      | 3.585  | 3.785  |
| c1            | 0.400  | 0.500  | 0.600  | ØP            | 3.740      | 3.840  | 3.940  |
| D             | 9.100  | 9.200  | 9.300  | Q             | 2.600      | 2.740  | 2.940  |
| D1            | 15.200 | 15.400 | 15.600 | R             | 0.108 REF. |        |        |